



Ambient Technology has prepared a number of documents describing the ambient samplers and sampling network (including the results of audits and calibrations) which is included as Appendix J.

## 2.2 Source Sampling and Characterization

To obtain the detailed chemical composition of aerosol sources which was necessary for chemical mass balance modelling, an extensive source sampling program was conducted. Figure 2 schematically illustrates three categories of particulate sources and the method used to collect representative samples of the aerosols they produce. The three types of aerosol sources are: (1) point sources (stacks), (2) process fugitive sources and (3) passive fugitive sources.

Table 7 lists the point sources and process fugitive sources sampled at East Helena. Structures that enclosed process areas were sampled with standard dichotomous and low volume samplers located near roof vents. On the ASARCO plant complex, the D & L building (sinter building), the New Deal building (ore proportioning building), the zinc plant (zinc furnace building), the dross building (dross kettle/reverberatory-furnace building) and the zinc fume baghouse building were sampled in that fashion, as well as American Chemet's zinc kiln room. Particles produced by blast furnace upsets and slag pouring were sampled by positioning equipment in an area where their episodic emission "plume" would impact it heavily. The samplers were started when a slag pour commenced or when the first sign of a furnace upset was noted. The samplers were shut off when the plume from the respective events no longer visually impacted the samplers. A single filter was left on the samplers so that a cumulative sample was collected from representative sampling of a number of short term emission plumes. A cumulative sample was desirable to integrate emission variability and collect a relatively large sample mass for chemical analysis. Both dichotomous and low volume samplers were used to sample blast furnace upsets. Only a low volume sampler was used to collect the slag pouring aerosol due to the difficulty of positioning equipment near the high temperature molten slag.

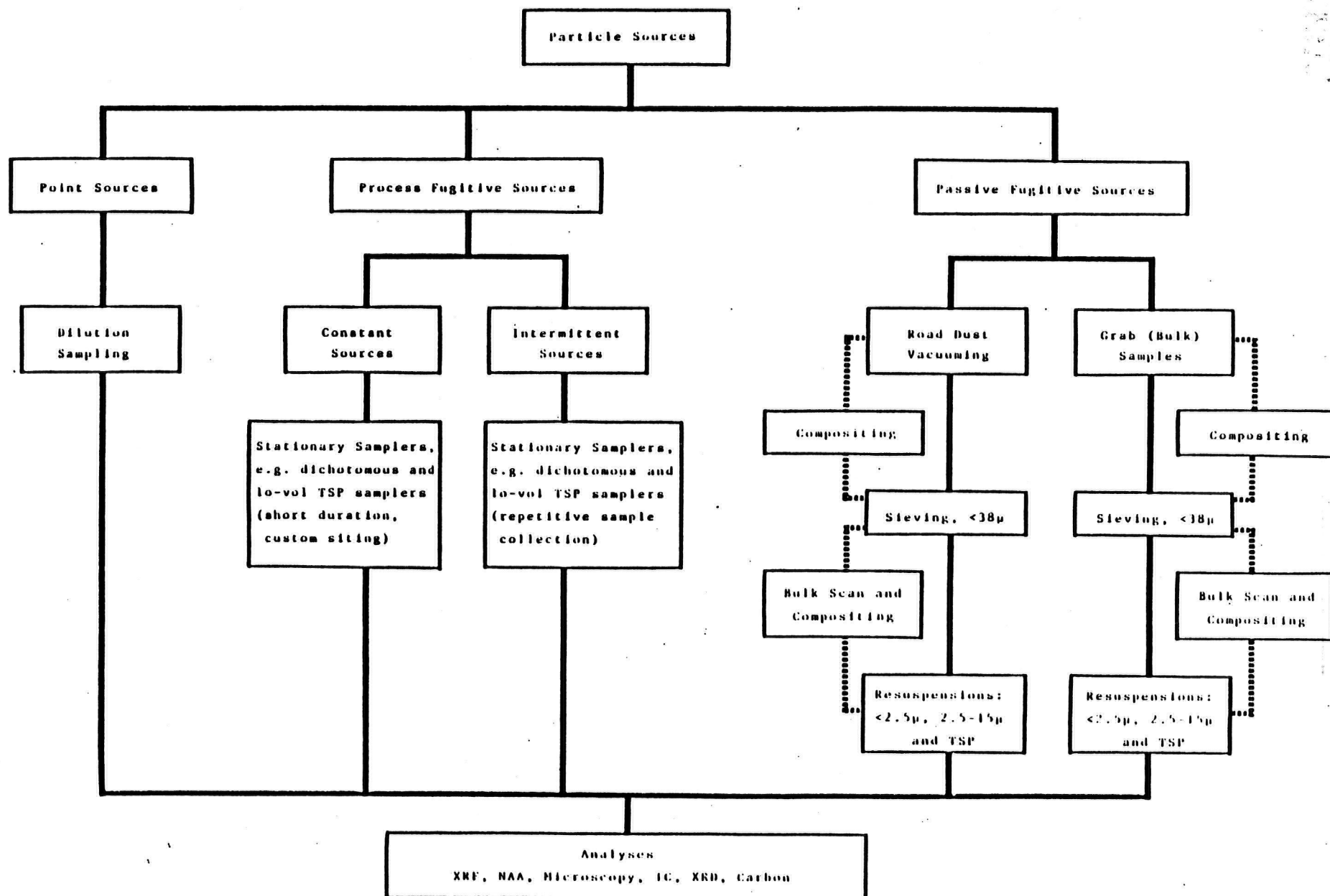


Figure 2 Schematic of Aerosol Source Sampling

Table 7

## Process Fugitive, Stack and Miscellaneous Sources

<u>Source Code</u>	<u>Description</u>
DLBLD	D & L Building
NDBLD	New Deal Building
ZNBLD	Zinc Plant
DRBLD	Dross Building
ZNGBG	Zinc Baghouse
BLFUP	Blast Furnace Upset
MSSTK	Main Sinter Stack
ZNSTK	Zinc Stack
BGSTK	Baghouse Stack
SLPOR	Slag Pour
ZNKLR	Zinc Kiln Room
ZNKLD	Zinc Kiln Discharge
CUKST	Copper Kiln Stack
CUINC	Copper Incineration
DIESL	Diesel Exhaust
SECO	(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> - Secondary Sulfate
WSTOV	Helena Wood Stove
TRANS	Vehicular Exhaust
RDOIL	Residual Oil Combustion

The three major ASARCO stacks were sampled with a dilution/cooling system (Figure 3). The three stacks are (1) the zinc fuming stack, (2) the main (sinter) stack and (3) the baghouse (blast furnace) stack. A complete description of dilution source sampling for chemical mass balance source apportionment is presented in Appendix B. The fundamental purpose of dilution sampling is to collect stack particles in the form they are in after mixing and cooling with ambient air which occurs when they are emitted from the stack environment. The dilution sampling system isokinetically withdraws a sample of stack gas, mixes it with filtered ambient air at a dilution ratio of between 20:1 to 100:1, and collects a size categorized sample ( $<2.5\mu$  and  $>2.5\mu$ ) onto teflon filter media. The temperature at the point of sample collection is generally only several degrees above ambient and the filter media used for sample collection is identical to that used for ambient field sampling which facilitates comparisons between the chemistry of stack and ambient aerosols. By cooling and diluting stack aerosols, the chemistry and size distribution obtained is closer to that which actually impacts ambient sites due to condensation, vaporization, agglomeration and secondary chemical reactions which would not occur if a sample were collected directly inside the stack.

In addition to the process fugitive and stack sources sampled by standard techniques, several other sources were sampled and are listed in Table 7. American Chemet's copper kiln stack was sampled by holding a high volume stack sampler fitted with an 8" X 10" teflon filter over the stack and by holding scalping cyclones followed by a back-up teflon filter also over the stack. This was determined to be the most appropriate sampling strategy since there were no available stack sampling ports and the stack plume was at low temperature at the point of sample collection. Similarly, American Chemet's zinc kiln discharge vent was sampled by positioning a low volume sampler in the horizontally directed discharge flow. A wood smoke sample was collected in Helena due to the proximity of residential wood combustion stacks to several of the ambient sampling sites. Wood smoke samples were collected with low volume and dichotomous samplers which were held in a wood smoke plume (Table 8). A laboratory simulation of

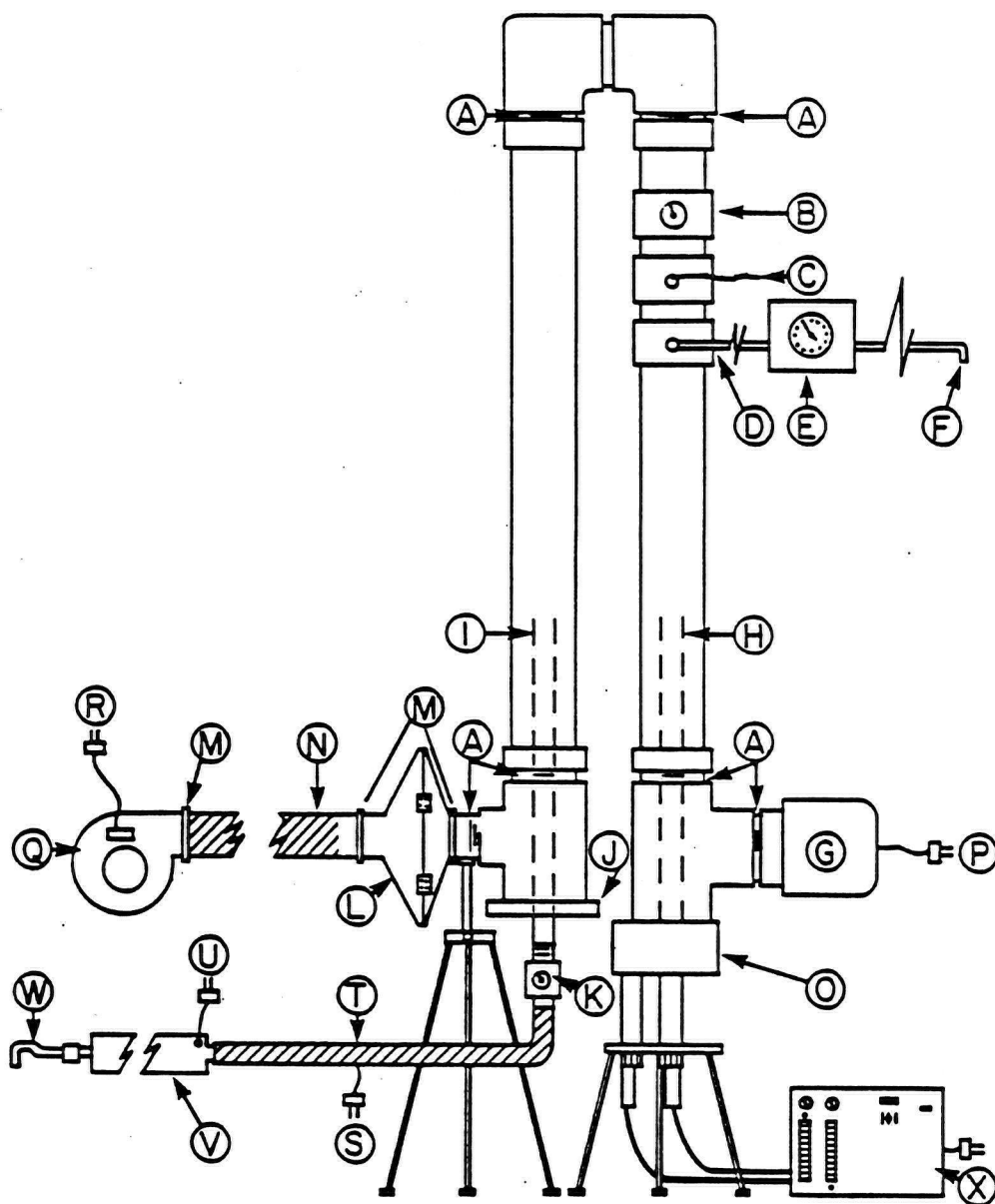


Figure 3. Dilution Source Sampler

(Not drawn to scale.) Height is approximately 2 meters, and unit is constructed with 10.2 cm (4 inch) diameter pipe. Design features include: (A) Threaded connectors for disassembly and transport, (B) thermometer, (C) gas velocity sensor to thermal anemometer, (D) static pressure sensor, (E) Magnehelic gauge, (F) total pressure sensor for in-stack measurements, (G) high volume vacuum motor, (H) interchangeable (0.64 to 2.54 cm I.D.) dichotomous inlet pipe, (I) stack gas inlet pipe, (J) stainless steel and asbestos end assembly, (K) threaded union with thermometer, (L) hinged 20 cm x 25 cm (8 inch x 10 inch) filter holder, (M) quick disconnect fittings, (N) flexible hose, (O) dichotomous sampler head, (P) power cord from high volume vacuum meter to a variable transformer, (Q) high volume blower, (R) power cord to a variable transformer, (S) power cord to heat tape, (T) insulated stainless steel teflon tubing, (U) power cord to heat tape, (V) 1.5 meter stainless steel stack probe, (W) button-hook sampling nozzle, and (X) dichotomous sampler control unit.

Table 8

## Wood Stove Samples Collected January 19, 1982

David Maughan

Run	Start	Flow End	Lapsed Time	Filters	Comments
(#1)	T-16.7 1/min C-1.67	4.0 1/min 0.60	7 min 5 sec	C-HD523 F-HD524	Fire condition-Two logs exterior burned off but still uncracked through center. Unburned wood on ends. Ashes cleaned out about 6 hours prior to test. Pine wood (both dry and green). Low fire about 1/4 way through burn process.
(NEA Tare wts HD 523 - 92.09 mg HD 524 - 93.14 mg)					
(#2)	T-16.7 C-1.67	16.6 1.65	15 min.	C-FRED6 F-FRED5	Fire conditions - as above, but less visible smoke. Fire temperature increased toward end of test period. Continuation of run #1 burn.
(#3)	T-16.7 C-1.67	4.3 0.3	15 min	C-HD525 F-HD526	Fire conditions - new, dry pine logs; substantial smoke; some large visible soot particles suspended in smoke beginning of burn.
(#4)	T-16.7 C-1.67	16.5 1.64	30 min.	C-FRED3 F-FRED4	Fire conditions - burning hot and fast during first 10 minutes then damped down. Dry pine used during burn. Continuation of run #3.

February 3, 1982

(#5)			8.5 min.	FRED1 47 mm quartz	Fire start-up with one medium-sized split, dry pine piece of wood. Smoke gray to black.
(#6)			15.0 min	FRED2 47 mm quartz	Just after fire start-up, mostly dry pine but with some dry fir. Hot fire which generated very little smoke, consequently stove air inlet was shut-down by about 75%. Fire burned at about 33% of heating capacity. Minimal whitish smoke visible from chimney.
(#7)			10 min.	HT415 47 mm TFE	Wood mixture as above. Hot fire but few flames - red hot coals. Few visible emissions from chimney during test. Stove air reduced by about 75% to generate medium smoke.

Stove Description - (Fisher Papa Bear) air tight wood stove with a 23-foot brick over clay-flue-lined chimney. All were in excellent condition.

Outside temperature during tests was about 5-10°F. A Sierra dichotomous sampler was modified for the tests by placing a seven-foot pipe between the bead and the particle separation unit. Typically this pipe is about 10 inches long. The sampler head, pipe, and separator were cleaned prior to the tests. The pump unit worked properly.

particles produced by American Chemet's copper incineration stack was conducted by the State of Montana and the particles produced were collected with a low volume sampler (Table 9). A large diesel exhaust sample was collected by State of Montana personnel with a high volume sampler. The material collected with the high volume sampler was removed, resuspended in the laboratory into  $<2.5\mu$ ,  $2.5-15\mu$  and TSP size categories. Additionally, several source fingerprints were taken from NEA's Source Library and are listed in Table 7. Those were (1) secondary sulfate  $(\text{NH}_4)_2\text{SO}_4$ , (2) vehicular exhaust and (3) residual oil combustion. A total of nineteen point source, process fugitive source and relevant miscellaneous source fingerprints were compiled for the East Helena Study.

The resuspension of dust by vehicular traffic has been shown to be a major source of coarse particles ( $>2.5\mu$ ) and a minor source of respirable particles ( $<2.5\mu$ ) in numerous studies. Road dust is particularly important in and around industrial complexes due to the increased vehicular traffic associated with industry and track-out of commercial materials. The characteristic chemistry and morphology of resuspended road dust originating from commercial materials is typically quite distinct as compared to urban or rural road dust. The sampling strategy for road dust collection entailed collection of samples from haul roads, urban streets, highways and rural roads.

A modified hi-vol sampler was used to collect road dust samples. Using the hi vol "vacuum" sampler, samples were collected from paved roads, unpaved roads, coarse gravel roads and from railroads. Once the road dust samples were collected, the samples were sieved and resuspended in the laboratory onto dichotomous and lo-vol TSP samplers. A number of the samples were composited to reduce the total number of samples on which detailed analysis had to be performed. Appendix A lists the detailed procedures for road dust sample collection and the subsequent laboratory procedures for resuspension.

Windblown dust from material storage piles, waste piles, exposed soil surfaces, etc. is an important source of particles particularly in the coarse size fraction. Grab sampling followed by laboratory sieving and resuspension was used to characterize the ambient particles originating from these sources.

Table 9

EAST HELENA CHEMET INCINCERATION SAMPLES  
January 7, 1982

David Maughan

- Test 1 HT 320 for 9 min 40 sec. using NEA lo-vol added about 6 grams of American CHEMET red copper material (Sample 21 Grab sample D, collected 11/12/81) from railroad tracks west of CHEMET. Material was placed in a stainless steel beaker, heated with a lab-flamed-burner to red hot temperature. The SS-beaker was supported in an inverted gallon-size clear glass pyrex beaker. A NEA lo-vol filter was supported adjacent to the top of the beaker, but also within the inverted glass bowl. The whole apparatus evolved considerable whitish smoke. The tests were performed in a Department of Health laboratory hood.
- Test 2 HT-318 Void. Sample flow was increased at the lo-vol pump and the filter was positioned within the smoke plume--but the filter holder melted.
- Test 3 HT-319 for 4 minutes but with decreased flow. We used about 15 grams CHEMET copper scale material. (Sample already sent to NEA about January 20, 1982.)

The collection of representative grab samples from each friable industrial storage pile, dusty unpaved roads where the road dust sampler could not be used, and from exposed soil surfaces such as agricultural fields produced many more samples than could be analyzed within the scope of this project. To reduce the total number of individual samples, bulk and soil (and road dust) samples were composited. Three approaches to compositing were taken. For the slag pile with a very large surface area, a transect sampling plan was developed and a large number of samples were collected, composited to form integrated samples representative of large areas of the slag pile, then sieved and resuspended. For soil and road dust samples collected from various locations which could not be assumed a priori to be similar in composition, the samples were first sieved to less than  $38\mu$ , then a semi-quantitative XRF scan was conducted on the bulk samples. Based on the similarities or dissimilarities detected by the XRF scan, the samples were composited before resuspension and before detailed analyses were conducted. For the ore concentrates and residues samples, only those materials which were routinely stored in large quantities were resuspended and analyzed. Samples from different piles of ore concentrates or residues from the same source (as identified by ASARCO records) were composited to produce a more representative sample. An overall composite fingerprint was also formed for ore concentrates and residues by mathematically averaging the elemental concentration data determined for all the ore concentrate and residue samples analyzed. This overall composite fingerprint is identified by the source code ORCOM in Appendix D.

Nineteen composite road dust and soil samples were formed and analyzed (Table 10). These were formed from nineteen individual soil samples and twenty-one road dust samples collected in the East Helena area (Tables 11 & 12). Figures 4 and 5 illustrate the soil and road dust collection sites.

Twenty-six miscellaneous bulk samples were collected, resuspended and analyzed (Table 13). These bulk samples were primarily industrial materials and by-products stored in the East Helena area. One winter road sanding/salting mixture was also included among the samples. Four of the miscellaneous bulk samples were slag composites. A description of the slag

Table 10

## COMPOSITE SOIL, ROAD DUST AND RAILROAD SAMPLES

SAMPLE I.D.	CONSTITUENT SAMPLES	DESCRIPTION	RATIONALE	RESUSPENSION I.D.		
				FINE	COARSE	LO-VOL
A	Soil 1	Padbury Site soil	Background soil	RS420	RS421	RL045
B	Soil 2	Microwave Site soil	Very high Ca	RS422	RS423	RL046
C	Soils 3, 4, 5, 6, and 15	Vollmer Site soil & soil collected near water tank west of ASARCO.	High Ca Low Pb, Cu & Zn	RS450	RS451	RL058
D	Soils 7, 8, 9, 999 (16), 18 & 19	Canal Site soil above Prickley Pear Creek flood plain near Dartman Site	Slightly lower Ca than Sample C; Slightly higher Pb, Cu & Zn than Sample C	RS452	RS453	RL059
E	Soil 10	Soil from bank immediately south of Hadfield Site	Intermediate levels of Ca, Pb, Cu & Zn	RS424	RS425	RL047
F	Soils 11, 12, 13 & 14 Road Dusts 13 & 18	Soil from around Firehall Site, from Prickley Pear flood plain and from dirt road to houses west of ASARCO	Higher Ca than samples C & D, low Cu, Zn appx. same as sample D, Pb same as Sample C	RS454	RS455	RL060
G	Soil 1000 (17)	Turn around area next to paved roadway, American Chemmet, RR & dirt road west of ASARCO	Highest soil Cu, Zn & Pb; high Ca	RS426	RS427	RL048
H	Road Dust 1	Interstate Hwy, 200 meters south of Padbury	Impact of Hwy on background site	RS428	RS429	RL049

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Table 10

## COMPOSITE SOIL, ROAD DUST AND RAILROAD SAMPLES (cont.)

SAMPLE I.D.	CONSTITUENT SAMPLES	DESCRIPTION	RATIONALE	RESUSPENSION I.D.		
				FINE	COARSE	LO-VOL
I	Road Dust 2	Gravel road leading to Padbury Site	Impact of gravel road on background site	RS432	RS433	RL050
J	Road Dusts 3 & 11	Mont. Ave. leading to ASARCO housing and Hwy 287, 200 meters south of RR tracks	Impact on Hastie & Canal Sites, intermediate Cu & Zn, high Ca & Pb	RS456	RS457	RL061
K	Road Dust 4 & 5	Hwy 12	Impact on Hwy on Hadfield, Highway & Firehall Sites	RS458	RS459	RL062
L	Road Dusts 6, 7, 8 & 9	City streets adjacent to Firehall and Hadfield Sites	Intermediate Pb & Ca, high Zn & Cu	RS460	RS461	RL063
M	Road Dust 10	Probable impact of fugitive dust from limerock haul trucks	Very high Ca	RS434	RS435	RL051
N	Road Dust 12		Hwy impact on Canal Site	RS436	RS437	RL052
O	Road Dust 15	Probable impact of traffic to ASARCO plant	Impact on Hadfield, Firehall & Highway Sites	RS438	RS439	RL053
P	Road Dust 17	City street	Impact on Hastie Site	RS440	RS442	RL054
Q	Road Dust 20		Hwy impact on Hastie Site	RS443	RS444	RL055

Table 10

## COMPOSITE SOIL, ROAD DUST AND RAILROAD SAMPLES (concluded)

SAMPLE I.D.	CONSTITUENT SAMPLES	DESCRIPTION	RATIONALE	RESUSPENSION		
				FINE	COARSE	LO-VOL
R	Road Dust 21	Gravel Road	Impact on South Site	RS445	RS446	RL056
S	Railroad 1		RR impact on Hadfield, Highway & Firehall Sites	RS447	RS449	RL057

Road Dust Samples 14 and 16 were not composited as no sample stations were near these collection sites; there is no Road Dust Sample 19.

See additional tables for specific date and location of each individual soil, road dust and railroad sample.

Comments on chemistry in rationale column based on analysis of bulk samples ( $< 38 \mu$ ).

Table 11  
East Helena  
Soil Samples

<u>Sample No.</u>	<u>Date</u>	<u>Location and Comments</u>
1	9/15/81	15 meters east of Padbury Station, musselshell loam (high in lime).
2	9/15/81	Sampled several locations 10 to 15 meters from Microwave Station, fill material similar to Crago loam.
3	9/15/81	Plowed field 10 to 15 meters from Vollmer Station, Crago loam.
4	9/15/81	Sandy wash bottom and dirt road, 100 meters west of Vollmer Station, recent alluvium, sandy loam, low in lime.
5	9/15/81	Plowed field 100 meters west of Vollmer Station and 100 meters north of Sample #4, down hill from sampler and generally upwind. Sappington loam, less lime than Sample #3.
6	9/15/81	Wheat field (mostly bare ground) 200 meters west of Vollmer Station (very little lime).
7	9/15/81	30-35 meters S-SW of Canal Station, Nippt very cobbly loam, low in lime.
8	9/15/81	100 meters W-SW of Canal Station, Attewan loam.
9	9/15/81	5 meters east of Canal Sampling Station, very resuspendable material on dirt road to Sampling Station, Nippt cobbly loam.
10	9/15/81	Sample taken on bank 7 meters south of Hadfield Station, approximately 3 meters lower in elevation than sampling platform. Local fill material.
11	9/15/81	Dirt parking lot 25 meters north of Firehall Station.

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Table 11 (cont.)

East Helena  
Soil Samples

<u>Sample No.</u>	<u>Date</u>	<u>Location and Comments</u>
12	9/15/81	Low point between Pacific Street and Highway 12, 20 meters south of Firehall Station, probably transported and deposited by flood of May 22, 1981, silt-loam alluvium.
13	9/15/81	Prickly Pear Creek Bed, below high water mark, approximately 0.5 kilometers north of East Helena city limits, very cobbly sand and loamy sand, Dartman Ranch.
14	9/15/81	Integrated sample collected on recent flood plain (May 22 flood) between Prickly Pear Creek and Dartman Ranch, sample integrated approximately 200 meters of distance, all recent alluvium, same distance from East Helena as Sample #13.
15	9/15/81	Sample collected from dirt road near water tank 0.8 kilometers west of ASARCO plant. Road was along SW edge of plowed field, musselshell loam, high in lime, approximately 35 meters higher in elevation than East Helena.
999 (16)	9/16/81	Sample collected on Highway 287 right-of-way approximately .5 kilometers east of plant and 200 meters south of railroad.
1000 (17)	9/16/81	Sample collected in turn-around area next to paved roadway, American Chemet, railroad and dirt road to houses west of ASARCO.
18	9/24/81	Transect SE of Dartman monitors.
19	9/24/81	NW corner of Kleffner wheat field 300 yards south of Canal monitors.

Table 12

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East Helena  
Road Dust and Railroad Samples

<u>Sample No.</u>	<u>Date</u>	<u>Location and Comments</u>
RD1	9/16/81	Interstate 15, 200 meters south of the Padbury Station, east lane headed north.
RD2	9/16/81	Gravel road leading to Padbury residence, single lane 4 meters wide, approximately 35 meters N.W. of Padbury Station.
RD3	9/16/81	Montana Avenue leading to ASARCO housing east of plant, on railroad right-of-way.
RD4	9/16/81	Highway 12, directly across from American Chemet on the south and Cleveland Avenue on the north. Approximately 75 meters south of the Hadfield sampling station. Four lane highway, east bound lane only, no curb, center of road was concrete.
RD5	9/16/81	Same as sample 4 except west bound lane, curb on north side.
RD6	9/16/81	Cleveland Street, 15 meters east of Hadfield Station, no curbs.
RD7	9/16/81	Main Street, 20 meters north of Hadfield Station, curb on north side of street, none on south side.
RD8	9/16/81	Corner of Pacific and Cleveland Streets, 1 block (~50 meters) south of the Hadfield Station, curb on north side, none on south side.
RD9	9/16/81	Corner of Morton Street and Pacific Street directly in front of Firehall Station. Curb on east side of Morton Street.
RD10	9/16/81	Junction of Highway 287 and ASARCO haul road, paved road.
RD11	9/16/81	Highway 287, 200 meters south of railroad.
RD12	9/16/81	Highway 12, east end of East Helena, approximately 40 meters north of Canal Station.
RD13	9/16/81	Dirt road to houses west of ASARCO, south of railroad.
RD14	9/16/81	Junction of gravel road and paved road, 75 meters west of baghouse stack, sample from gravel road.
RD15	9/16/81	Highway just west of ASARCO and Chemet, just south of railroad track.
RD16	9/24/81	Gravel road about 200 feet SSW of Sinter stack near ASARCO entrance into cooling towers.

Table 12 (cont.)

## East Helena

## Road Dust and Railroad Samples

<u>Sample No.</u>	<u>Date</u>	<u>Location and Comments</u>
RD17	9/24/81	Paved street 75 feet south of Hastie monitors, no curbs.
RD18	9/24/81	Driveway dust - dirt/gravel, Dartman residence, about 100 feet SSW of sampler.
*		
RD20	9/24/81	Four-lane paved highway south of Hastie monitors. Sample includes median area and both west and east lanes. North edge does have curb, but not south.
RD21	9/24/81	Abandoned gravel road just north of south monitor and at Kleffner property boundary. Part of the sample included pasture area below the monitors.
RR1	9/16/81	Burlington Northern Railroad adjacent and north of American Chemet, sample collected with road dust sampler.

\* No Road Dust Sample 19.

RD - Road Dust

RR - Railroad

Table 13

## MISCELLANEOUS BULK SAMPLES

SAMPLE I.D.	DATE OF COLLECTION	DESCRIPTION AND/OR LOCATION	RESUSPENSION I.D.			COMMENTS
			FINE	COARSE	LO-VOL	
I-1	11-81	Clean-up pile C from lower storage area.	RS356	RS369	RL009	
I-2	11-81	Dross skims from six-high bins.	RS358	RS359	RL010	
I-3	11-81	Sinter from stock pile belt near blast furnace.	RS360	RS361	RL011	
I-4	11-81	Sulfur flux from six-high bins.	RS362	RS363	RL015	
I-5	11-81	Lime rock from lake shore storage area.	RS364	RS365	RL013	
I-7	11-81	Blast furnace baghouse dust.	RS366	RS368	RL014	
I-8	11-81	Acid plant hot cottrell & baghouse dust.	RS370	RS373	RL016	
I-9	11-81	Soda from six-high bins.	RS374	RS375	RL017	
I-10	11-81	Zinc oxide from ASARCO zinc oxide baghouse.	RS378	RS379	RL019	
I-11	11-81	American Chemet copper kiln discharge.	RS376	RS377	RL018	
I-12	11-81	American Chemet zinc fume (marketed product).	RS380	RS381	RL020	
I-14	11-81	Granulated coke from six-high bins.	RS382	RS383	RL021	
I-15	11-81	Black, beaded granular material (perhaps coke) collected from near thaw house.	RS384	RS387	RL022	

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Table 13

## MISCELLANEOUS BULK SAMPLES (continued)

SAMPLE I.D.	DATE OF COLLECTION	DESCRIPTION AND/OR LOCATION	RESUSPENSION I.D.			COMMENTS
			FINE	COARSE	LO-VOL	
I-16	11-81	Granular coal or coke collected from pile NE of thaw house.	RS388	RS389	RL023	
I-17	11-81	Coal from pile west of Pile 58.	RS390	RS391	RL024	
I-18	11-81	Coal from pile north of Pile 58.	RS392	RS393	RL025	
I-19	11-81	Coal from Pile 58 in coal storage area on west end of plant near American Chemet.	RS394	RS416	RL026	
I-20	12-81	Sand and salt used on icy roads. Collected by David Maughan.	RS412	RS413	RL035	
II-2 (Grab Sample J)	9-81	Red colored material collected on RR right-of-way west of American Chemet.	RS404	RS405	RL031	
II-3 (Grab Sample Q; Grab Sample 24)	9-81	Black material collected on RR right-of-way west of American Chemet.	RS406	RS407	RL032	
III-1 (Grab Sample A)	9-81	Coke collected from RR right-of-way west of ASARCO.	-	-	RL044	Sample ground. Resuspended on Lo-vol only.

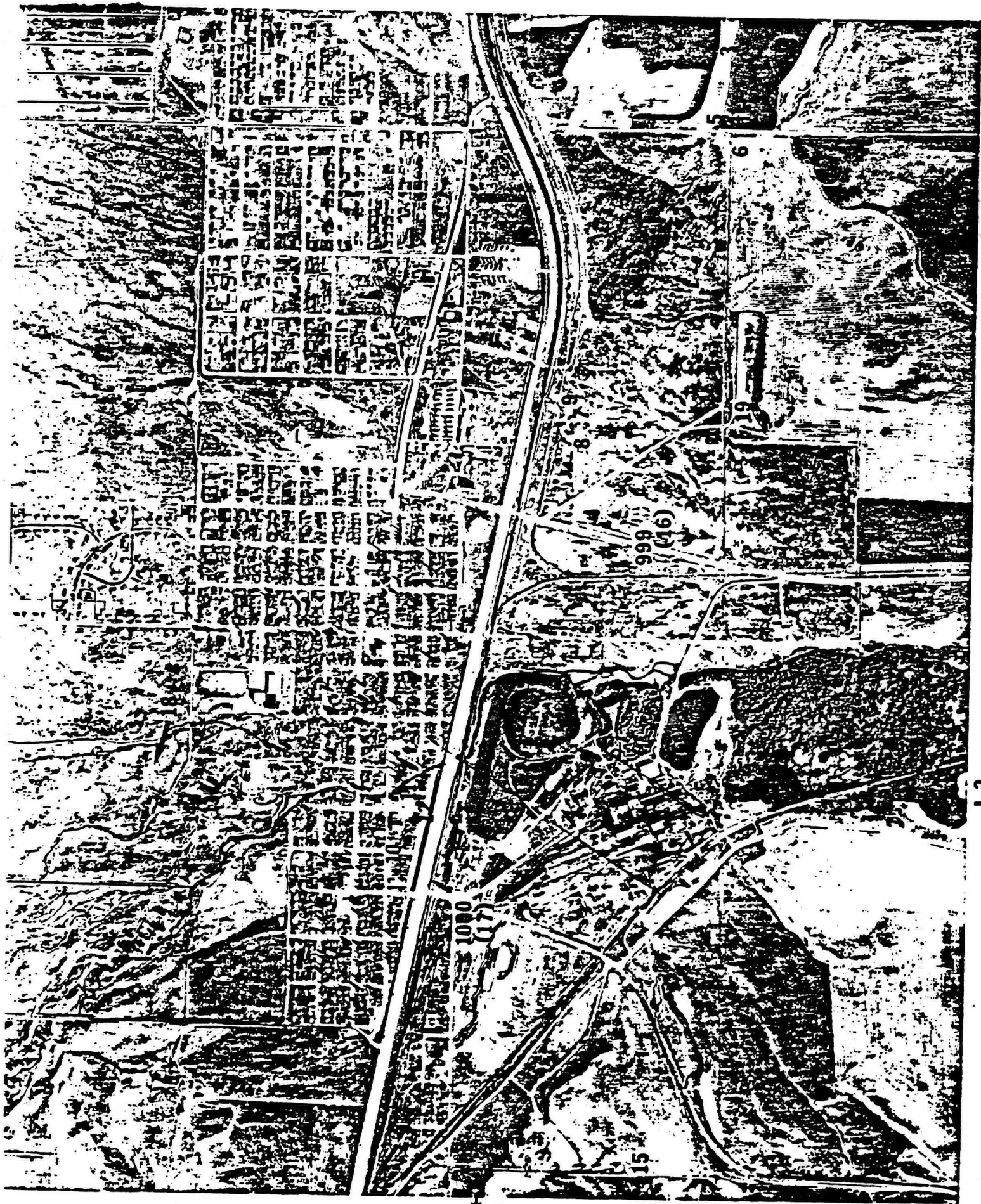
Table 13

## MISCELLANEOUS BULK SAMPLES (concluded)

SAMPLE I.D.	DATE COLLECTION	DESCRIPTION AND/OR LOCATION	RESUSPENSION I.D.			COMMENTS
			FINE	COARSE	LO-VOL	
III-3	11-81	Speiss (fresh material) from pile storage area near dross building.	-	-	RL-040	Sample ground. Resuspended on Lo-vol only.
IV-1	11-81	Slag Sample Composite W.* Formed from 12 samples collected on west "leg" of slag pile.	RS396	RS417	RL042	
IV-2	11-81	Slag Sample Composite C.* Formed from 6 samples collected on center mound of slag pile.	RS398	RS399	RL028	
IV-3	11-81	Slag Sample Composite S.* Formed from 4 samples collected on south "leg" of slag pile.	RS400	RS401	RL029	
IV-4	11-81	Slag Sample Composite M.* Formed from 6 samples collected in slag mining area.	RS402	RS419	RL030	

\*See Table    for description of slag sample composites.

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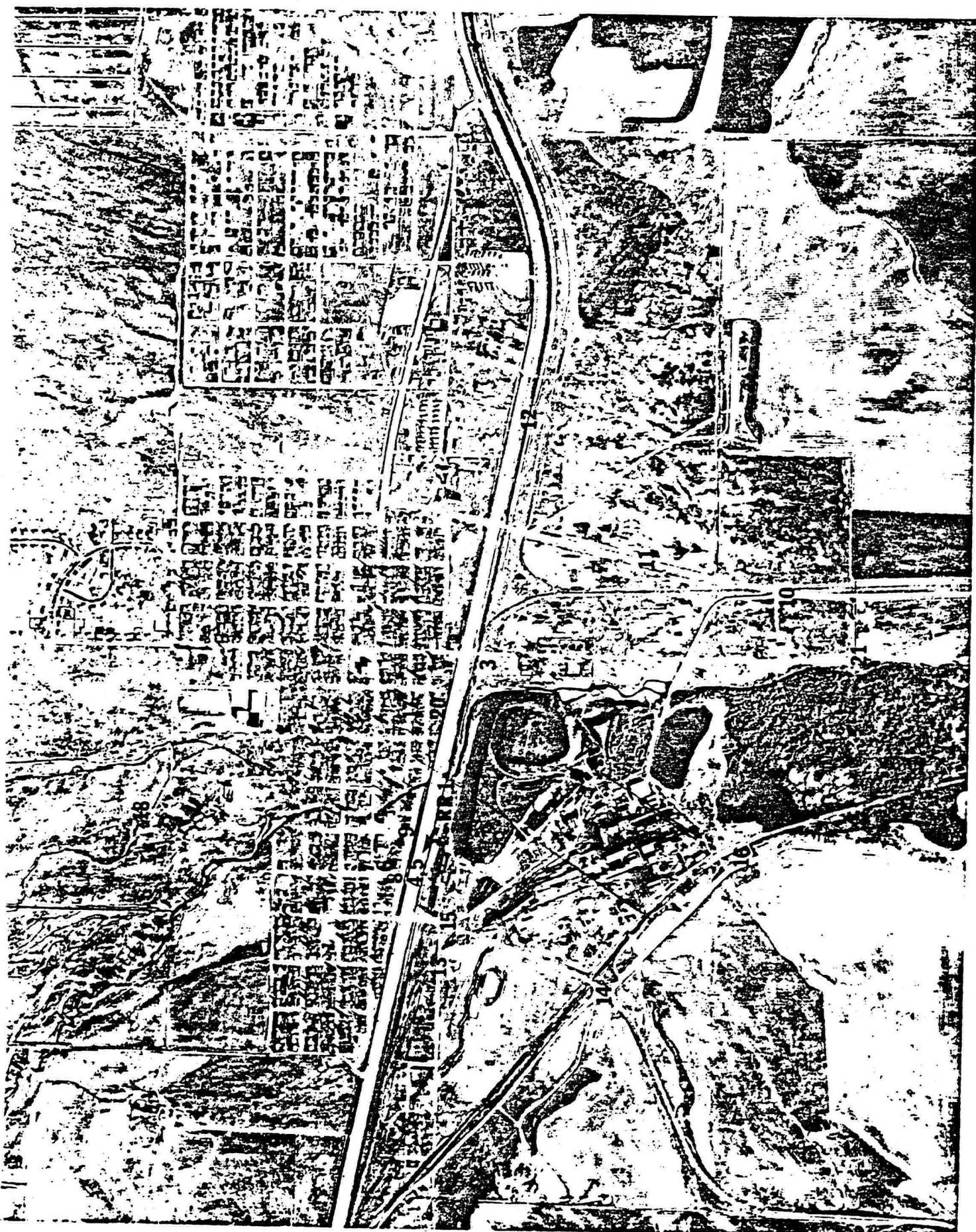


Figure 5 Road Dust Collection Sites

composite is given in Table 14. The fourteen ore concentrate and residue samples are described in Table 15. Appendix A lists the procedures for bulk and soil sample collection and the subsequent procedures for laboratory resuspension.

### 2.3 Chemical and Mass Analysis

Thin film energy dispersive x-ray fluorescence spectrometry (XRF) was performed on all valid ambient and source samples collected with the dichotomous, lo-vol and dilution samplers. The XRF analysis was accomplished with an Ortec TEFA III model 6110-40 analyzer. Three excitation conditions were used for each sample (Table 16). XRF calibration was accomplished with three types of standards: (1) thin film vapor deposited standards made by Micromatter, Inc., (2) multielement solution deposited standards prepared by Columbia Scientific Industries and (3) particle standards also prepared by Columbia Scientific Industries. The standards were verified by theoretical plots of instrument response versus atomic weight.

For each XRF analysis run of ten samples, a quality control standard was analyzed. Measured concentrations of this standard, which contains several key elements, were compared with actual concentrations. If the deviation was more than  $\pm 2\%$  for any of the elements, all samples in that run were re-analyzed. Several elements, including K, Ca, Fe, As, Br and Pb, were measured under more than one of the three excitation conditions used. Results of these elements were compared for each of the excitation conditions under which they were measured. If agreement was not within error bars, the sample was re-analyzed. For each XRF analysis run of ten samples, a blank was also run.

To further verify the accuracy and precision of data obtained by thin film x-ray fluorescence spectrometry, NEA, Inc. participated in an EPA sponsored interlaboratory comparison of polymer film standards prior to this study. Seven other laboratories participated in the intercomparison, and in addition to energy dispersive XRF, other analytical techniques were used.